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Abstract

FUEL CYCLE COSTS FOR A LARGE NUCLEAR POWER PROGRAMME

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With the start of construction at the Wylfa site, the 5000 MW(e) programme of magnox reactor installation in Britain is approaching completion. A substantial further expansion during the next decade is expected. Prior to the introduction of the Fast Reactor on a commercial scale much of the additional capacity will probably consist of more advanced types of thermal reactor. Development in the U.K. has concentrated on the Advanced Gas-Cooled and the Steam Generating Heavy Water Reactors. A prototype of the first of these has been operating at power at Windscale for more than a year, and construction of an S.G.H.W. prototype is under way at the Authority's Winfrith Establishment. The two parts of this paper discuss different aspects of the fuel cycle costs anticipated for this programme.

In Part I, the fuel cycle costs of Magnox, A.G.R. and S.G.H.W. are discussed and compared, both average values expected for the first ten years of the installation of any one reactor type and the long term trends that are anticipated. Effects of possible variations in uranium ore and enrichment prices are demonstrated, together with the cost reductions that can arise from improved fuel management policies and irradiation limits. Design trends leading

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to lower costs in the long term are identified.

U.K.A.E.A. work on the physics of plutonium utilisation in these systems has shown that it should be possible to introduce plutonium based fuel into both the A.G.R. and S.G.H.W. systems without major changes in reactor design. The economics of the use of plutonium in this way is discussed and the relation between Pu values in these systems and in a fast reactor discussed and illustrated.

Part II discusses the influence on the fuel cycle costs of the scale of the enrichment, fabrication and reprocessing facilities supporting the programme. With an expanding programme, numerous possibilities exist for inter-linking the fuel cycles of the three thermal reactor systems both through the existence of common facilities and through the use of reject uranium from one system as feed for another or for a diffusion plant. To realise these possibilities and the resultant economies, the fuelling operation must be planned as a whole. The effects of changing fuel design and irradiation targets on the demand for production capacity further complicate the position.

Thus, whilst comparisons of fuel cycle costs for the individual reactor systems are necessary when considering e.g. relative rates of installation, cost estimates of the enrichment and processing components of the costs of each system cannot be considered wholly in isolation. These factors are taken into account in discussing the utilisation of the existing production facilities, their future extension, and the cost variations anticipated in meeting the needs of the British Power Programme.